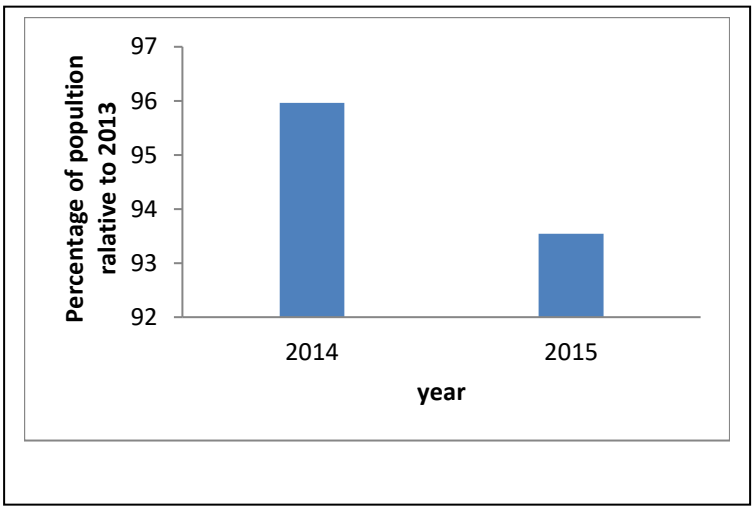
FINAL ANSWER FOR BIOLOGY SOLUTION : 6 Desember 2016

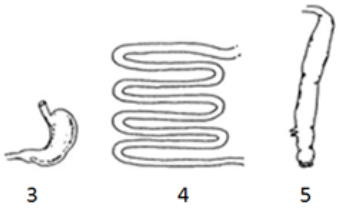
1.	Answer : D and F
Point: 1	Explanation : D. Animals that use behavioral adaptation to manipulate temperature F. Ectothermic animal: Animals referred to cold blooded, they are hot when their environment is hot and cold when their environment is cold

2.	Answer : I
Point: 1	Explanation : Heparin, acts to inactivate thrombin and prevent the conversion of fibrinogen to fibrin

3.	Answer : B and G
Point: 1	Explanation : B: Predator: T: Carnivore G: Third tropic level → compulsory Mature komodo dragon's prey mainly are life deer and wild buffalo G and B = 1.0 point G and T = 1.0 point G, B and T = 1.0 G, other than B and T = 0.5 point No G, with either B and T = 0.5 point

4.	
Point: 2	Percentage 2013: 100% 2014 : 95.97% (point 0.5) 2015 : 93.54% (point 0.5)  Figure 1. Komodo Population Total point of construction histogram is 1. 5 item answers @ 0.2 point: Histogram title, x-axis title (year), y-axis title (percentage), year of observation (2014, 2015), the graph must be a histogram. Option: 1. The graph must be a histogram, others are incorrect 2. The keyword for title of the histogram is Komodo Population 3. X-axis title keyword: year 4. Y-axis title keyword: percentage or %. As long as consistent in writing style, any number or scale is allowed. 5. 2014, 2015. Extra 2013 is allowed.

5.	Answer : P and Q
Point: 1	Explanation : (P.) Decreasing the population of komodo-dragon's prey And (Q) lost of komodo Habitat

6.	Answer : H (3,4,5)
Point: 2	Explanation :  A pure carnivore has a simple tube for an intestinal system. That tube has a bulge at the beginning of it that serves as a stomach. The tube then winds and twists inside the abdomen of the carnivore. **Cecum:** The cecum in a carnivore digestive system is a tiny useless appendage

7.	Answer : @ 0.286
Point: 2 @ 0.286	1.1 : $Z^{N}Z^{n}$ 1.2 : $Z^{N}W$ 2.1 : $Z^{n}W$ 2.2 : $Z^{N}Z^{n}$ 2.3 : $Z^{N}W$ 3.1 : $Z^{N}W$ 3.3 : $Z^{n}W$

ATTENTION

This table is used for question number: III. 1,III. 3,III. 5

Number of expected correct answer(s)	Number of answer(s)	Number of correct answer(s)	Point
2	2	2	1
	2	1	0.5
	3	1	0.5
	3	2	0.5
	4 or more	Not to be considered	0

Question contain only one correct answer (III.2)

Number of expected correct answer(s)	Number of answer(s)	Number of correct answer(s)	Point
1	1	1	1
	2	1	0

Question contain only one correct answer (III.6)

Number of expected correct answer(s)	Number of answer(s)	Number of correct answer(s)	Point
1	1	1	2
	2	1	0

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SOLUTIONS AND MARKING SCHEME

Problem I. Chemistry

Question	Content	Points	Total
I.1	As a weak acid (HA), eugenol is partly dissociate in water to give H_3O^+ and A^- ions, according to the following equilibrium reaction: $HA + H_2O \rightleftharpoons H_3O^+ + A^-$ The dissociation constant is given by $Ka = [H_3O^+][A^-]/[HA]$; From the equation, it is understood that $[H_3O^+] = [A^-]$ 1.64 g of eugenol = 1.64 g / 164 $g.mol^{-1}$ = 0.01 mol Since it is dissolved in 1 L solution, the concentration of eugenol = 0.01 M	0.5	1.5
	Therefore $[H_3O^+]^2 = K_a[HA]$ or $[H_3O^+] = \sqrt{(Ka[HA])} = \sqrt{(6.5 \times 10^{-11} \times 0.01)} = 8.06 \times 10^{-7}$; since $pH = -\log[H_3O^+]$, then **pH = 6.1**	1.0	
I.2	Hydrogen = 6/16 x 128 g = **48 g**	0.25	0.5
	Carbon = 60/16 x 128 g = **480 g**	0.25	
I.3	The mass of the product (ethyl eugenolate and hydrogen bromide) is equal to the sum of the masses of the eugenol and ethyl bromide consumed. The mass of materials not involved in the reaction are unchanged. Therefore, the total mass after reaction is **41.0 g**		0.5
I.4	As a weak acid (HA), eugenol is partly dissociate in water to give H_3O^+ and A^- ions, according to the following equilibrium reaction: $HA + H_2O \rightleftharpoons H_3O^+ + A^-$ The dissociation constant is given by $Ka = [H_3O^+][A^-]/[HA]$; From the equation, it is understood that $[H_3O^+] = [A^-]$ Therefore $[H_3O^+]^2 = K_a[HA]$ or $[H_3O^+]$ from eugenol = $\sqrt{(Ka[HA])} = \sqrt{(6.5 \times 10^{-11} \times 0.02/2)} = 8.06 \times 10^{-6}$ As a strong acid HCl completely dissociate in water to give $[H_3O^+]$ = 0.02/2 = 0.01 M Hence the total $[H_3O^+]$ in the solution = $[H_3O^+]_{eugenol} + [H_3O^+]_{HCl} = (0.01 + 8.06 \times 10^{-6}) \approx 0.01$ M Hence, the pH of the solution = $-\log [H_3O^+]$ = **$-\log 0.01 = 2$**		1.0
I.5	Since the stoichiometric of the reaction is 1:1, it means that one mole of eugenol requires 1 mole of diethyl sulphate. Mr of Eugenol = (10 x 12) + (12 x1) + (2 x 16) = 164 $g.mol^{-1}$ Mr of diethyl sulphate = (4 x 12) + (2 x 5) + (1 x 32) + (4 x 16) = 154 $g.mol^{-1}$ Hence 82.0 g of eugenol = 82 g/164 g. mol^{-1} = 0.5 mol, and 115.5 g of diethyl sulphate = 115.5 g/154 $g.mol^{-1}$ = 0.75 mol Therefore, the remaing reactant is 0,25 mole of **diethyl sulphate** = 0,25 mol x 154 g/mole = **38.5 g of diethyl sulphate.**	0.5 0.5 0.5	1.5

I.6	Initial KOH= 30 mL x 0.25 mmol/mL = 7.5 mmol	0.3	1.5
	The excess of KOH= 10 mL x 0.25 mmol/mL = 2.5 mmol	0.3	
	KOH consumed for determination of acid value: (7.5-2.5) mmol = 5 mmol	0.3	
	mg KOH consumed for 2 g of sample = 5 mmol x 56 mg/mmol = 280 mg	0.3	
	Acid Value = 280 mg/2g = 140 mg KOH/g sample	0.3	
I.7	The polarity of carboxylic acid increase with the decrease in the number of carbon, so the lauric acid with 12 carbon is the most polar followed by myristic and palmitic acids. Since the stationary phase is a polar materials and the solvent is non-polar, the lauric acid will have retardation factor (R_f) lowest and followed by myristic and palmitic acids, or (1) R_f lauric acid < (2) R_f myristic acid < (3) R_f palmitic acid		1.0
I.8 (1.5)	Mr of $C_{11}H_{23}COOH$ = (12 x 12) + (24 x 1) + (2 x 16) = 200 $g.mol^{-1}$ Mr of CH_3OH = (1 x 12) + (4 x 1) + (1 x 16) = 32 $g.mol^{-1}$ Mass of CH_3OH = 160 mL x 0.8 $g.mL^{-1}$ = 128 g Mole of CH_3OH = 128 g/32 $g.mol^{-1}$ = 4 mol Mole of $C_{11}H_{23}COOH$ = 100 g/200 $g.mol^{-1}$ = 0.5 mol Suppose the ester formed = x mol, the H_2O produces x mol, then The remaining lauric acid = (0.5-x) mol and the remaining methanol = (4.0-x) K_{eq} =x.x/(0.5-x)(4.0-x) → $0.1x^2 + 4.05\ x - 1.8 = 0$ By using abc formula, we have x = 0.45 mol	1.0	1.5
	Hence, the ester formed = 0.45 mol x 214 $g.mol^{-1}$ = **96.3** g	0.5	
I.9	26 g C_2H_2 = 26 g : 26 mol . g^{-1} = 1.0 mol	0.5	1.0
	40 g HCl = 40 g : 36.5 mol . g^{-1} = 1.1 mol		
	As mol C_2H_2 is smaller than mol HCl, so the formed C_2H_3Cl will be equal to the mol of C_2H_2, i.e. 1.0 mol or equivalent to **62.5 g**	0.5	
			10

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Problem II. Physics

Question	Content	Points	Total
II.1	Correct formula $p_{total} = p_{atm} + \rho gh$	0.5	1.0
	Correct total pressure = 3.03×10^5 N/m^2 = 3.03×10^5 Pa = 3.00 atm. $3.00 \le p_{total} \le 3.06 \times 10^5$ N/m^2 or $2.97 \le p_{total} \le 3.03$ atm is acceptable	0.5	
	Incorrect/incomplete solutions:		
	Correct value without unit	0.3	
	Formula only $p_{total} = \rho gh$	0.2	
	Other formulas	0.0	
	Total pressure $2.70 \le p_{total} < 2.97$ atm or $3.03 < p_{total} \le 3.30$ atm	0.2	
	Other values	0.0	
II.2	Correct formula total time $t = \dfrac{\text{Total volume of air consumed}}{r} = \dfrac{V_f - V_i}{r}$	0.4	2.0
	Correct Boyle law $P_iV_i = P_fV_f$ or $V_f = \dfrac{P_iV_i}{P_f}$	0.4	
	Correct formula for total pressure $p_f = p_{atm} + \rho_{sw}gh$	0.4	
	Correct formula for total time $t = \dfrac{V_i(p_i - (p_{atm} + \rho_{sw}gh))}{r(p_{atm} + \rho_{sw}gh)}$	0.4	
	Correct value of total time t = 55.5 minute. The total time $54 \le t \le 57$ minutes is acceptable	0.4	
	Incorrect/incomplete solutions:		
	Total volume of air consumed = V_f	0.2	
	Total pressure $P_f = \rho_{sw}gh$	0.2	
	The total time is 50 minutes < $t \le 54$ minutes or 57 minutes < $t \le 60$ minutes	0.2	
	Other total time	0.0	
II.3	Correct international unit: 1/(watts /(m^{2}K)) = m^{2}K/W = m^{2}K/(J/s) = m^{2}Ks/J	0.5	1.5
	Correct the best material: N	1.0	
	Incorrect/incomplete solutions:		
	Incorrect SI unit	0.0	
	Incorrect the best material	0.0	
II.4	Correct formula: $h = \Delta p/\rho g$	0.5	1.0
	Correct value of depth: h = 3.47 m The range of depth $3.41 \le h \le 3.55$ m is acceptable	0.5	
	Incorrect/incomplete solutions:		
	Correct depth without unit	0.3	
	Incorrect formula	0.0	
	The depth is 3.15 m $\le h <$ 3.41 m or 3.55 m < $h \le$ 3.80 m	0.2	
	Other value of depth	0.0	

Question	Content	Points	Total
II.5	Pressure at the depth 30 m = 4 atm	0.3	1.0
	Correct formula: Boyle law	0.3	
	Correct value of volume V = 1.50 L The volume 1.45 L ≤ V ≤ 1.55 L is acceptable	0.4	
	Incorrect/incomplete solutions:		
	Correct volume without unit	0.2	
	Incorrect formula	0.0	
	The volume is 1.35 L ≤ V < 1.45 L or 1.55 L < V ≤ 1.65 L	0.2	
	Other volume	0.0	
II.6	Correct equation of force with or without force diagram	1.0	2.0
	Correct formula of $b = \frac{m_s g}{v_t}\frac{\rho_s - \rho_{sw}}{\rho_s}$	0.5	
	Correct value of $b = 5.55\times10^{-2}$ kg/s The value b $5.45 \le b \le 5.65\times10^{-3}$ kg/s is acceptable	0.5	
	Incorrect/incomplete solutions:		
	Correct b without unit	0.3	
	All forces are written, however wrong signs	0.5	
	Not all forces are written	0.0	
	Incorrect formula of b	0.0	
	The value of b $5.35 \le b < 5.45\times10^{-2}$ kg/s or $5.65 < b \le 5.75\times10^{-2}$ kg/s	0.2	
	Other value of b	0.0	
II.7	Correct formula: Snell law	0.5	1.5
	Correct formula of angle in sea water	0.5	
	Correct value of angle = 48.8°. The angle rounded to 49° or 48.3° ≤ θ ≤ 49° is acceptable.	0.5	
	Incorrect/incomplete solutions:		
	Incorrect Snell law	0.0	
	Incorrect formula of angle in water	0.0	
	The angle 47.0° ≤ θ < 48.3°	0.2	
	Other angles	0.0	
	Total points for Problem II		10

Notes:

- no double penalty
- this marking scheme is a guidance for all physics juries.
- other ways for physics formula derivations are acceptable, if physically correct.